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Title: Immersive Simulation Training: Comparing the impact on midwifery and paramedic students' confidence to perform basic life support skills

Article Type: Original Research

Keywords: Simulation; immersive environments; higher education; confidence; basic life support; student training

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Abstract: Background: Simulated practice using high fidelity has been shown to have significant benefits in the medical and nursing field. However, the benefits among paramedical and midwifery students are not well known.
Aim: The aim of this study was to explore and compare the impact of Immersive Simulation Training (IST) on midwifery and paramedic students' confidence to perform a skill (basic life support) in real-life stressful and life-threatening scenarios.
Design: A mixed-method approach with an explanatory sequential design was used.
Setting and participants: Seventeen first year student midwives and paramedics were recruited from one Higher Education Institution.
Measurements: A validated confidence questionnaire and focus groups were used to collect data.
Findings: Students' confidence following IST was significantly improved when compared to confidence following conventional simulation training (CST); a statistically significant increase of 6.71 (95% CI, 3.57 to 9.84), $p < 0.001$. Additionally, five themes were identified; 'Needing a solid foundation', 'The role of peer support' and 'It is just not real' following CST and 'A steep learning curve' and 'A whole new world' following IST.
Conclusion: The study identified the important role of CST to establish a foundation but the need for escalation to IST to ensure deeper learning and preparedness for real life scenarios and should both be integrated in curricula.

Detailed Response to Reviewers

Reviewer #1: This paper is well written. However, it would benefit from following the EQUATOR COREQ guidelines for reporting on qualitative research and would be strengthened if this did occur.

We definitely did want to use a guideline to report our research, however, we could not use the EQUATOR COREQ as this is based on qualitative reporting whereas our study was mixed methods. We welcome any guideline such as PRIMSA or EQUATOR-COREQ we can use to present mixed-methods.

In the method section of the qualitative section there was no mention of who conducted the focus groups (FG), the credentials of the researcher who conducted the FG, their experience and relationship with the participants.
Further detail added to methods section to address this issue.

The method of approach to the participants was not included.
This has been rectified and method (via email through university accounts) was added.

It was not explained how the interview guide was developed, how the data was collected eg audio recording and if field notes were included. It was not explained if transcripts were returned to participants for verification.
Many thanks for highlighting these oversights. They have been added to the manuscript. Transcripts were not returned to participants for verification due to time constraints.

There was no discussion on why only 17 participants in FG. Was this due to data saturation or another reason?
All recruits participated in the focus groups. We amended the text slightly to make this explicit.

In relation to the analysis the number of coders was not discussed and if software was used in the analysis. The reporting of the findings was clear. The quotes were well presented to illustrate the major themes. The discussion section was sound.
No software was used. This was added. Thank you for the lovely comments regarding findings and presentation.

The highlights section discusses "Immersive simulation training can increase students' confidence to perform life saving skills in real scenarios" and "Conventional simulation training is an important foundation for students to cement basic clinical skills", however the study only researched the effects on midwifery an paramedic students. Need to review this statement
Thank you for the comment, we have amended the highlights slightly.

Reviewer #2: Thank you for the opportunity to review this paper. Your research such an important issue for paramedic and midwifery students and I look forward to seeing how it will impact and improve student education.

Introduction
Line 33-50References required to support your statements in these sections.
Some updates provided, very difficult due to paucity in research.

Materials and Methods
Line 54Figure 1 - Further detail in this diagram would strengthen your methodology. You have referenced Creswell 2015 - can I recommend you explore his work in more recent publications, as

there are some excellent diagrams to help you clarify each step. For example, Step 2 in explanatory sequential designs is important to specify how your findings from the quant phase were used to inform the qual phase.
In our study the quant phase did not inform the qualitative phase as they happened right after each other (minutes apart) and the findings of the quan did not shape the qual. The quan was merely followed up by qualitative phase (a very basic MMR approach) so we felt that a very simple diagram sufficed. We only wish we had the time and resources to explore this further however now that we have an idea of the feasibility of this approach we aim to follow up with further projects.

Line 57How did the students receive their initial BLS training (prior to this study)? Could this have impacted the results? A sentence or two to clarify would be helpful.
Clarified.

Line 60-61How were the sample sizes determined? 4 of each for the quantitative strands feels small. What evidence can you provide to support these sample sizes?
Further clarification provided.

Line 71What were considered basic competencies? These should be specified for transparency.
Thank you, this has been rectified.

Line 83This scenario appears very appropriate for paramedicine students, but it unclear how realistic it is for midwifery students. If your aim was to simulate a realistic situation for both groups of students did you consider using a pregnant pedestrian in the street scenario instead? Additionally, the pressures experienced by staff resuscitating a pregnant patient are significantly more stressful due to having both a mother and a baby to consider. Consider including an explanatory statement around how the final scenario was determined.
Thank you for this question, it has remit, however, the purpose of choosing BLS was because all health care students need to be BLS competent without being field specific. Realistically, midwifery students need to be competent and perform BLS on both pregnant and non-pregnant patients, as well as, paramedics. The scope of this study was not to have field specific scenarios but generic scenarios which both fields need to be competent in.

Line 94Did the findings from the qualitative phase inform the quantitative phase questions, or were these determined a priori? Explanation of this step is required.
This comment confused us a bit as the quantitative phase occurred first followed by the qualitative, so we are not sure whether this comment is an error or whether we are misunderstanding it.

Additionally, do you have an overview of the students - eg. age ranges, gender? This may also impact the interpretation of your findings.
No we did not have demographics. We could only report on gender as we did not collect demographics and we felt that simply reporting on gender would enhance the interpretation of the findings.

Results
Line 164Was consideration given to using peer review by peers who did not know each other and how this may impact outcomes? In paramedicine and in in-hospital cardiac arrests, you may not know the peers you perform a resuscitation with and I wonder if this decrease in familiarity may impact trust and therefore your results.
We think we understand what you mean but the scope of this study is for educational purposes so students will always have a sense of familiarity as they will always be peers. However, as we only

had one cohort per discipline, we could not have altered this in any case but there is potential for further research.

Line 169Could the findings actually be more about the attitudes of the peers you work with rather than familiarity? Could positive and supportive attitudes from resuscitation teams regardless of familiarity be as impactful?
This was not present in their focus groups.

Discussion
Line 244Some interesting and exciting findings in here. Lots of potential to improve practice. Well done.
Thank you, it got us excited as well!

Line 264You talk about recent literature but reference papers from 2007 and 2010. Can you identify more recent papers to support your work?
Sadly, at present there is no stronger evidence which is more recent in this context.

Line 283An excellent point about the vulnerability contributing the students' learning. Was there any evidence to support your findings?
We could not find any supporting literature in this context and with this specific detail.

Line 309"…deemed necessary." Was this by the students or by Arthur, et. al.?
Amended, thank you.

Line 318This is quite an old reference and there are more recent ones to use. I would recommend updating this.
We were referring to the original author but have nonetheless included a more recent reference.

General comments
*An important topic with significant implications for paramedic and midwifery education. Well done on an excellent choice.
*Concern that references throughout the paper are older. Can these be updated? – Done so when able to
*Further information is required for the materials and methods/methodology section to provide transparency and strengthen your paper. – Updated throughout

Cover Letter

Rory McKelvin, Giliane McKelvin
Edge Hill University
St Helens Road, Ormskirk, L39 4QP

13th October 2019

Dear Prof Debra Bick,

We wish to submit an original research article entitled "Immersive Simulation Training: Comparing the impact on midwifery and paramedic students' confidence to perform basic life support skills" for consideration by Midwifery.
We confirm that this work is original and has not been published elsewhere, nor is it currently under consideration for publication elsewhere.

In this paper, we report how increasing realism in pe-registration simulation training enhances students' confidence to practice in real life emergency situations across two disciplines; midwifery and paramedicine. However, this increased fidelity needs to follow more basic simulation as this enables students to become confident in the technical skill. This is significant because it highlights how simulation training needs to develop and enhance in fidelity to bear more resemblance to real situations as it helps students more confident to participate and manage emergency situations.

We believe that this manuscript is appropriate for publication by Midwifery because it explores a growing field of research in health care education (immersive simulation training) from an interdisciplinary perspective. So far there has been no evidence to support immersive simulation training across midwifery or paramedicice but has shown positive implications in the nursing and medical field. The significance of this new approach to simulation training can have a direct impact on student learning and with the new Nursing and Midwifery Council standards for education, it is an opportune time to disseminate this research as Universities across the UK will be preparing their new curricula.

We have no conflicts of interest to disclose.

Thank you for your consideration of this manuscript.

Sincerely,

Rory McKelvin & Giliane McKelvin

*Title Page (including author details and affiliations)

Immersive Simulation Training: Comparing the impact on midwifery and paramedic students' confidence to perform basic life support skills

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Conflict of interests

The authors declare that there is no conflict of interest.

Ethical Approval

Ethical approval was confirmed by the Research Ethics Committee at the Faculty of Health and Social Care, from the University (REC-FoHSc).

Funding

Not applicable

Highlights

- Immersive simulation training can increase paramedic and midwifery students' confidence to perform life saving skills in real scenarios
- Conventional simulation training appears to be an important foundation for students to cement basic clinical skills
- The foundation training provided through conventional simulation must be escalated to enhance realism by utilising high fidelity environments, mannequins and psychological stressors to enhance student learning.

Abstract

Background: Simulated practice using high fidelity has been shown to have significant benefits in the medical and nursing field. However, the benefits among paramedical and midwifery students are not well known.

Aim: The aim of this study was to explore and compare the impact of Immersive Simulation Training (IST) on midwifery and paramedic students' confidence to perform a skill (basic life support) in real-life stressful and life-threatening scenarios.

Design: A mixed-method approach with an explanatory sequential design was used.

Setting and participants: Seventeen first year student midwives and paramedics were recruited from one Higher Education Institution.

Measurements: A validated confidence questionnaire and focus groups were used to collect data.

Findings: Students' confidence following IST was significantly improved when compared to confidence following conventional simulation training (CST); a statistically significant increase

of 6.71 (95% CI, 3.57 to 9.84), $p < 0.001$. Additionally, five themes were identified; 'Needing a solid foundation', 'The role of peer support' and 'It is just not real' following CST and '*A steep learning curve'* and '*A whole new world'* following IST.

Conclusion: The study identified the important role of CST to establish a foundation but the need for escalation to IST to ensure deeper learning and preparedness for real life scenarios and should both be integrated in curricula.

Keywords

Simulation; immersive environments; higher education; confidence; basic life support; student training

Introduction

Simulated practice has become a key educational strategy across health education (Cant & Cooper, 2010). It is considered to be a teaching strategy which is performed in a controlled and safe environment that aims to improve the quality of care provided to patients. In recent years the World Health Organisation (WHO, 2013) has advised that health professionals' education and training institutions should use simulated methods of contextually appropriate fidelity levels in the education of health professionals. A key benefit of simulation training is the expansion and consolidation of knowledge which does not simply include the ability to apply theory to practice. Acquired knowledge can also be in the form of advancing technical skills such as venepuncture as well as transferable skills such as effective team communication and reflection. Most importantly simulation training offers students the opportunity to develop these skills in a safe environment, as such, recent years has seen multiple universities build simulation centres to enable simulation training as part of their educational health programmes (Lendahls & Oscarsson, 2017).

There is a wide range of simulation modalities that can be used in health care education, ranging from anatomic models (low-fidelity) to high-fidelity simulators and virtual reality simulators (among others). In view of this wide range of options, it is the facilitator's role to determine which simulation modality would be most appropriate should be used. The fidelity and modality of simulation depends on the learning objectives outlined in the programme, the perceived level of the student, and the ability of the modality to engage students (Issenberg et al., 2009).

Fidelity is the extent to which the appearance (physical fidelity) and behaviour (functional fidelity) of the simulator or simulation match the appearance and behaviour of simulated system.

The physical fidelity is the degree to which the training device or environment replicates the physical characteristics of the real event. The functional fidelity is the degree to which the skill, task or behaviour of the real task is captured in the simulation or simulator (ASPiH 2016).

It is becoming increasingly evident that high-fidelity simulation enhances student engagement as it allows for individualised learning and the ability for students to identify and correct mistakes in a safe and controlled environment (Issenberg et al., 2009). It has also been proven to enhance student competencies (Reynolds et al., 2010; Smith et al. 2012), with some evidence to suggest that it may impact students' self-efficacy as well (Hughes et al., 2014). While these are key outcomes, the impact of high-fidelity simulation training on students' confidence level is limited and mostly restricted to nursing and medical education.

Student confidence is an important component to explore, particularly in relation to emergency life-saving scenarios, as these are skills which students are often least exposed to on placements or at times inhibited from leading on. This can result in students feeling reluctant to engage in these scenarios due to the lack of confidence to participate in such a busy, stressful and often chaotic environment (Wright et al., 2018). Thus, it is vital to explore methods to enhance students' confidence while maintaining a high level of competency throughout their training. One such method can potentially be high-fidelity simulation.

One such component of high-fidelity simulation is through the use of immersive technology, where not only high-fidelity mannequins can be used but the surroundings are manipulated in a controlled manner to create a more realistic environment (Lopreiato, 2016). By practicing emergency life-saving skills in an environment which is more in tune with the realities of actual emergency situations, students may potentially feel increasingly confident to perform the skills

learned. As such, since the use of immersive simulation training and its relation with student confidence, remains an unexplored area, further exploration is warranted. Therefore, the aim of this project is to explore and compare the impact of Immersive Simulation Training (IST) on midwifery and paramedic students' confidence to perform a skill in real-life stressful and life-threatening scenarios. Basic Life Support (BLS) was the chosen skill as this is a universal skill which every health care professional needs to be competent and confident in across the UK.

Materials and methods

Research design

A mixed method approach with an explanatory sequential design was used for this study (Creswell, 2015) (Figure 1).

INSERT FIGURE 1 HERE

The target population consisted of first year paramedic and midwifery students studying at a Higher Education Institute in the North West of UK who had already received BLS training through conventional methods as part of their course. Convenience sampling was deemed ideal for this project due to the time constraints involved (Saunders et al., 2012). A pragmatic approach was taken to determine sample size due to a very small target population and participation rates which have been documented to be typically above 25% (Bedger & Werrett, 2004). With this participation rate and the smallest target population in mind, it was envisioned that at least seven midwifery students and seven paramedic students would be recruited. The size of focus groups has been reported to be appropriate anywhere between four and 12 participants (Carlsen & Glenton, 2011). thus, for the qualitative strand a target of four students from each discipline was set.

Methods

The paramedic and the midwifery lead disseminated information to their corresponding students via email through their university account. Students were informed of the study and invited to participate emphasising that participation is voluntary and would not impact their performance on the course. Due to the small target population, efforts were aimed at appealing to students' intrinsic motivation by highlighting the benefits of the project to their personal and wider education (Sauro, 2016) and providing a certificate of participation.

On the data collection day, students were asked to sign a consent form, informed of the structure of the day and received detailed information of what the separate simulations training sessions entailed (figure 2). In phase one, students were assessed on their competency using Conventional Simulation Training (CST). At this stage students kept practicing until they met the basic competencies as specified by the UK Resuscitation Council (Perkins et al., 2015). All the students were then provided with a 5-minute confidence questionnaire, followed by a focus group. In phase two, students had the same competencies assessed individually using IST. Students remained in the immersive suite for a maximum of five minutes each or until they met their competencies. Similarly, they were then asked to complete the same questionnaire and focus group.

INSERT FIGURE 2 HERE

The CST session was delivered in a classroom environment. The skill was practiced in small groups while the facilitator and other students observed. A BLS CPR torso training mannequin was used. The IST environment consisted of environmental stressors such as noises and sounds (ex: trucks passing by) to emulate the environment the skill was to be performed in (a cardiac

arrest in a public street). A full-scale adult mannequin as opposed to the CPR torso was used. The mannequin was also fully dressed in running gear and a bicycle helmet. There was no facilitator in the room with the student during the time of the scenario but were observed through one-way glass. Students were briefly informed of the environment and skill they were expected to perform before entering the scenario.

Measures and analysis

A modified structured questionnaire the "Self-Confidence Survey" which was adapted by Omar (2016), was used to assess students' self-confidence. The adapted version has a Cronbach's Alpha 0.96 (Omar 2016). The questionnaire consisted of 10 questions on a Likert scale of 0 – 6. For the IST another question was added asking to rate the statement "I found the immersive simulation useful in preparing me for real patients" from 0 – 6. This was analysed using descriptive and inferential statistics through SPSS.

A semi-structured interview with open-ended questions was used in the focus groups. The interview schedule was designed by the authors in line with the aim of the study, as such, the schedule included questions to explore how students felt performing the skill through IST vs CST, how the different approaches influenced their confidence and if it prepared them for practice. The focus groups were audio recorded and notes were taken during the session which led to further questions for each group. To minimise response bias, the focus groups were led by two lecturers with experience in conducting focus groups and who had not taught the same group of students before, however, all the students were aware that they were members of staff. Braun and Clarke's (2006) thematic analysis approach was used to determine students' perception of IST vs CST and the potential impact on their confidence. This included getting familiar and

immersed in the data during verbatim transcription, manually identifying codes and sorting them into potential over-arching themes and sub-themes and further analysis and refinement of each theme.

Ethical approval was confirmed by the Research Ethics Committee at the Faculty of Health and Social Care, from the University (REC-FoHSc).

Results

Twenty-six first year student midwives and 45 first year paramedic students were invited to participate. Seven (25.9%) student midwives and ten (22.2%) first year paramedics were recruited. All 17 students that were recruited, participated by completing the questionnaires and participating in the focus groups.

Quantitative findings

Descriptive data of students' confidence scores (n=17) after CST, after IST and the how their confidence changed is presented in table 1. Difference in confidence values was compared between midwives and paramedics (Table 2). Students were finally asked whether they found their immersive simulation exercise useful in preparing them for real patients (Table 3).

INSERT TABLE 1 HERE

INSERT TABLE 2 HERE

INSERT TABLE 3 HERE

Inferential statistics were undertaken to determine if there is a difference (Table 4):

1. in confidence values between CST and IST

2. in change of confidence values between midwives and paramedics

3. between the change of confidence value between midwives and the overall score

4. between the change of confidence value between paramedics and the overall score

5. in how useful IST was in preparing students for real patients between midwives and paramedics

INSERT TABLE 4 HERE

For Test 1, students' confidence following IST was significantly improved (43.76 ± 2.61) as opposed to the confidence following CST (37.05 ± 5.85); a statistically significant increase of 6.71 (95% CI, 3.57 to 9.84), $t = 4.54$, df = 16, $p < 0.001$. Cohen's d was calculated at 1.479. In the second test, there was no significant difference between the two change in confidence value scores ($U = 16$, $N_1 = 7$, $N_2 = 10$, $p = 0.063$, two-tailed). Test 3 indicated that the median increase value (9.00) of midwives' change in confidence between CST and IST was not significantly different from the overall sample median 7.00, ($Z = 1.625$, $p < 0.104$). For test 4, change of confidence value following IST for paramedics was on average lower ($M = 4.4$, $SD = 6.06$) compared to the overall mean increase value of 6.71. However, the one-sample t-test showed that this was not statistically significant ($t = 1.20$, df = 9, $p = 0.259$, two-tailed). In test 5, the two groups of students showed similar scores and the test showed that there were no statistically significant results between the two ($U = 16$, $N_1 = 7$, $N_2 = 10$, $p = 0.393$, two-tailed).

Qualitative findings

All the participants were involved in their focus groups (n = 17) held with both midwives and paramedics following the CST session and IST session, totalling four focus groups.

Conventional simulation training

Data analysis following three CST focus groups revealed three themes; '*Needing a solid foundation', 'The role of peer support'* and '*It is just not real'.*

Needing a solid foundation. The first theme highlighted how CST was important as it provided students with a solid foundation of knowledge and skills. Students explained how '*whilst it is a synthetic environment, it definitely helps me learn'* (paramedic student). They were able to recognize how CST '*sets us up for the future with a good foundation'* (paramedic student). Students also reported that it impacts their confidence because;

> '*it gives you that step by step…having the step in your head in a calm way … it is good to build confidence and instilling the knowledge in you'* (midwifery student).

While the benefit of the method used was clearly identified, what seemed more crucial is repetition of the skill in question even using such a basic approach.

> '*What goes to show that even if we don't have a full clinical skills session set out for the day, even in the classroom setting every week or so we could just have half an hour session, just as a refresher…it is good for knowledge'* (midwifery student).

Finally, students commented how the type of environment contributed to being particularly beneficial as it allowed for a safe environment in which students were able to make mistakes and learn from them;

> *'I like doing it [BLS skill] in Uni because they are the times to make mistakes and they are the times to get corrected. So when we do it here, I don't feel bad if I make a mistake because it will get corrected but on the road when on your own it may not be picked up' (*paramedic student).

The role of peer support. An overwhelming majority of students commented how the setting of CST which meant that students were practicing the skill in front of a small group of people, was a benefit as it enabled more peer to peer support. Students explained that it invoked '*less anxiety'* because '*we were more relaxed as we all knew each other, and we knew who was watching us' (*midwifery student). Being in small groups allowed for enhanced learning, *'if you can practice with people that are really supportive in small groups, you can learn off each other and help, 'maybe you can try this instead of this' and that can be very positive'* (paramedic student) as opposed to large groups which can be '*off putting'* (midwifery student). More importantly, '*the tutor is always there'* (paramedic student) and '*an expert can guide you'* (midwifery student).

It is just not real. The final theme addresses the key limitation of CST which students discussed in detail. Students felt that through CST;

> '*you just do one thing; the whole environment is focused on that one skill but in reality you will have lots of things going on. It is not just that one patient. It is not just you. There are other people and factors to put into practice. In the*

classroom there are no stressors, it is just you and you have nothing else to worry about' (midwifery student).

Students explained that they can focus in the classroom because it is '*quite quiet but it will be different in the hospital'* (midwifery student) but they were concerned that other factors cannot be simulated. Students went on to explain how the equipment used is nothing like that in real life, '*I was listening for the click [while doing chest compressions] but in reality, you will not hear that'* (student paramedic). They explained;

'*Because you are in this type of environment, it just doesn't feel real and there is a lot of effort to be put in to pretend that it is real, so in the back of your mind you are thinking, 'actually I do not need to take this seriously because there is nothing on the line''* (paramedic student).

The lack of realism in the scenario prompted students to give advice on how it should be delivered explaining how '*it [CST] is only the first layer and it cannot stop there'* (paramedic student) and once the foundation is established, it needed to be built further. Unfortunately, because students felt that CST was the norm they were concerned that even though they were confident using those skills in the classroom, they may not be able to do the same in a real situation. Midwives explained how;

'if it was to happen in a real life situation it wouldn't be like that so even though I am confident in that type of scenario, put me in a real life scenario and I am aware that it may impact me differently because I would be aware that this is real not a dummy on the floor' (midwifery student).

Immersive simulation training

The two focus groups following the IST session revealed two themes; '*A steep learning curve'* and '*A whole new world'.*

A steep learning curve. Being alone in the immersive environment immediately made students realise that '*I needed to be more independent, use my own thought processes, my own skills, my own clinical judgement'* (paramedic student). Students found that they could not take a step back and rely on others but needed to think for themselves on more than just the skill itself;

> *'In that situation you were on your own, there was no one else helping you. There were so many things you had to think about, there was blood, the helmet was there, the arms where in the way, so it makes you think about all these things rather than just a torso'* (midwifery student).

The fact that they were alone in the scenario and new challenging environment created a steep learning curve for the students. It forced students to reflect on their actions during the exercise, '*you had no one else to rely on so it made you more aware of what you were doing and made you reflect on your mistakes'* (midwifery student). Being forced to reflect was particularly beneficial for the students as it helped them realise that there is more for them to learn;

> '*When I came out of that room, I know there were things I could have done better which tells me I am not at the top level and that is when you learn because that is where I want to be'* (paramedic student).

The IST scenario helped them want to improve further and engage in their learning a lot more. The situation took students '*out of my comfort zone'* and it started to challenge the decisions they

made in that scenario. This evoked the important role of debriefing as well which further enhanced their learning;

> '*If you give feedback it may surprise people how well they actually did and will improve the confidence further. We are all questioning ourselves, there was no peer review, so feedback will help us realise that we may need to improve but we were not as bad we thought we were and that helps with confidence'* (paramedic student).

Whole new world. Being in an immersive environment opened a whole new world for students. Students explained how it '*caught you off guard'* (paramedic student) yet it was '*exciting'* (midwifery student) and they were eager to do it again because it felt more real;

> '*That was more like real life, my survival instinct kicked in. I knew I had to do it. I felt like it was a real person, so I had to do it well. You will never get the true representation of what it would be like until you are in the true situation but that was the closest thing to reality.'* (midwifery student)

Students also considered the role that IST had in their learning and training. They emphasized that CST has a role to help them build the foundation but then the safety net needs to be removed and clinical skills escalated. '*The safety net is good for learning new skills but once you are competent you need to remove it and continue building and building'* (paramedic student). They discussed how fidelity needs to be enhanced, because '*when the mannequin is more life-like, it keeps you engaged, focused and entertained'* (midwifery student). At the same time students recognized that too much fidelity may cause increased anxiety or discomfort but '*if we do*

something here which is making us stressed or uncomfortable, that needs to be addressed' (paramedic student).

Most importantly students unanimously agreed that this whole new world enhances their confidence and they felt more prepared for practice and more willing to participate in emergency life-saving situations. Students appreciated the value of training under stressful circumstances, '*if you train under stress, you will feel less stress in reality'* (midwifery student) because it '*adds a new layer and dimension to our learning improving our resilience'* (paramedic student).

Discussion

The study has explored the use of the effects of IST on confidence levels of students from midwifery and paramedic backgrounds, compared to CST. It was identified that the type of simulation used impacted strongly on student confidence in a positive manner. The study also provided insight on how simulation training should be developed to enhance learning including the significance of having a foundation, escalating realism, peer support and debriefing.

Confidence and learning

Of most significance is the concept of confidence levels among students. Results showed that confidence levels were improved significantly when moving from the CST environment through to the IST environment. This was evident by the quantitative data and explored further through the qualitative data. This has already been identified and established in the wider nursing literature (Bambini et al., 2009; Wagner et al., 2009; Blum et al., 2010), however, it is new evidence for paramedic and midwifery training. More importantly, the data suggests that the use of IST is beneficial across disciplines. This is partially due to the added learning opportunities students were exposed to in that environment as they were able to take a holistic approach and

use their clinical judgement. This is a significant outcome from IST as it is well established that a well-developed clinical judgement skill represents the essence of health professional practice (Higgs et al., 2008).

Apart from the development of clinical and decision-making skills which students reported in their narratives and in recent literature (Lasater, 2007; Grant et al., 2010), in this study students went on to explain how they also felt ready to participate in real emergencies while on placement. This adds pressures on Universities to ensure students have the skills expected of them from their professional bodies such as the Nursing and Midwifery Council, to consolidate students' higher order thinking skills (Arwood & Kaakinen, 2009) and to ensure students are prepared to meet the demands of the work force and society once they graduate.

The findings also highlight that students experience the benefits of IST both in their early days of training and further into their programme. Student midwives had only practiced the basic life support (BLS) skill twice before they were exposed to the IST environment, whereas, student paramedics had practiced this skill several times as part of their programme and some students had already been exposed to the actual emergency. Despite a very basic foundation for student midwives and an escalation to the IST environment occurring only a few weeks after their initial foundation training within their programme, they still experienced a steep learning curve from their IST experience. This is in contrast to a recent Delphi study which expressed that simulations with increasing complexities and immersion should be provided over a period of time (Arthur et al., 2013). The rationale behind this recommendation from the Delphi study (Arthur et al., 2013) may be to minimize vulnerability and increased mistakes that may negatively impact confidence or to minimize stress or anxiety. All of these ideas were identified in this study; however, they were not recognized as problems but rather as opportunities for

298 growth by students themselves. In the first instance students highlighted that the vulnerability
299 they found themselves in, encouraged them to engage and problem solve while managing their
300 patient. Students also recognized that they had made some mistakes but this encouraged their
301 need to learn further instead of negatively impacting their confidence and learning. The students
302 found that they actively needed to reflect on their performance as their peers could not give them
303 any feedback as they did during CTS.

304 The need to reflect and learn from their mistakes was identified as a key component to their
305 learning and the significance of such is recognized in the literature (Bond et al., 2007; Redmond,
306 2017). Students also indicated that the immersive environment was a stress-inducing one,
307 however, they accepted that it needed to be so for them to feel adequately prepared for reality.
308 Finally, students also expressed a word of caution for the immersion and fidelity of the
309 mannequins to be too realistic too soon as they may provoke anxiety if students are not aware of
310 what they are going to be immersed into. However, students themselves said that this would need
311 to be addressed if it is the case as it would also be an opportunity to reflect on the cause for
312 anxiety and so sudden exposure to immersive training should not be excluded from their training.

313 These benefits may be attributed to the careful and precise preparation of every aspect of the
314 simulation training including the build up to the immersion, the scenario itself, the immersion
315 training and the follow-up debrief which students reported as being essential. After reflecting on
316 the comments from the students and being involved in the planning of the sessions, it appears
317 that when a simulation is created in IST for a skill, not only is the skill taught but many other
318 aspects of learning occur for the student. It is essential that the facilitators consider these impacts
319 when guiding the session. These elements have already been identified in literature (Cantrell,

2008; Arthur et al., 2013) and the importance of such highlighted to ensure adequate simulation training.

Building on a foundation

Even though the benefits of IST were clearly demonstrated and recognized by the students in this study, the need to build a foundation with CST was deemed necessary which supports previous research (Arthur et al., 2013). Students highlighted a distinct divide in the training environments and how they impacted on them. The CST environment was described as the "basic and foundational" type training environment not for what the training offered but what the learning environment lacked. There were little to no distractions, and it was a calm safe and relaxed environment which the students identified a good environment to begin learning a skill in. This effectively provides a secure learning environment for a skill set that is predictable and where distractions may hinder learning or focus, making it ideal for learning skills one is not experienced in or not yet comfortable with.

This concept of building on the foundation which students identified with bears resemblance to the concept of scaffolding developed by Bruner (1961) (Hammond & Gibbons, 2005) which has broadly been discussed in pedagogical literature. It highlights the needs for facilitators to be actively involved in students' learning at the early stages and then gradually reduce facilitator involvement as students gain confidence and competences. However, this study also shows the importance of the same scaffolding approach within simulation training as students specifically indicated the need for CST to establish the foundation while reaping the benefits of IST even in their first year of training.

Realism and escalation

Students explained how important realism was for them during the simulation exercise because that meant that they did not simply focus on the skill in question. Many students reflected on the IST session and commented on how it forced them to learn and act in a more realistic manner because they had to consider all the new influencing factors and because there was no-one to tell them what to do. The students noted that this forced them to physically act through the full motion of making the environment safe instead of purely commenting they would and putting pressures on themselves to do the skill correctly because it felt real. Students found value in having a more realistic environment and felt that this enabled them to be more prepared for a real-world emergency. This has also been identified in the medical literature (Gordon & Buckley, 2009) where medical graduate students who participated in immersive training identified that they felt more able to perform the technical and nontechnical aspects of responding to patient clinical emergencies.

It appears that students were making reference to the need for environment fidelity, equipment fidelity but also unknowingly to the degree of psychological fidelity. The environmental and equipment fidelity (alongside the scenario that was prepared) also brought about psychological fidelity as the simulation exercise mimicked the psychological processes (such as the stressors of dealing with an emergency situation) and tasks (such as assessing the scene for danger) that would be required in a real case (Rehmann et al., 1995; Beaubien & Baker, 2004). Psychological fidelity '*is the extent to which the training environment prompts the essential underlying psychological processes relevant to key performance characteristics in the real-world setting'* (Elliott & Coovert, 2017, p.76). Even though the concept of psychological fidelity had been mentioned in the literature over 20 years ago due to its incorporation of human factors (Rehmann

et al., 1995), the focus of fidelity has almost entirely been on environmental and equipment fidelity. Arthur et al., (2013) even advised that students should be fully aware of what simulation they are going in for and be fully aware of what the environment and scene would look like to avoid that element of surprise and risk of anxiety. However, this may take away from that psychological fidelity because as students in this study explained, when you walk into an emergency situation you may not know what you are walking into. Students even proposed the need to more IST with the added element of surprise and being in public so that they can feel that added sense of urgency and realism which they would come across when part of the work force.

Despite the significance of realism students explained that they would not benefit from experiencing IST without CST first. The students noted that the IST was beneficial but only if it was done in a specific step-wise manner. They emphasized that escalation must occur to ensure their learning and preparedness for practice. Escalation to IST also enhanced students' experience and engagement, reporting that it was more fun to be a part of. This is also an important element that Universities must take a note as IST may not only potentially ensure retention and enhanced employability but also student experience which collectively will improve the reputation of Universities (Office for Students, OFS, 2018).

Strengths and limitation

The strengths of this study are the interprofessional and innovative perspective that was taken. However, more importantly a rigorous approach was taken in the planning and execution phase. Researcher bias was minimized as no part of the study was done without a collaborative approach across the two departments and the differences in teaching approaches were brought together to strengthen the methods used. As the two departments which participated in this study have different requirements for their students to qualify and to be able to succeed in the work

place, there was a large difference to the foundations of the students. With this in mind the similarity of the results between years and departments showed a larger impact for this type of training to be implemented.

The major limitation of the study is the small sample size of the quantitative strand which was partially due to the small target population. It is also restricted to first year students who were relatively new to the skill being taught, differences may have been noted if students in their final year were included.

Recommendations for practice

Reflecting on the comments, data and results from the students, the authors reflected on a few key points when creating these environments. The environment needs to be able to reflect an accurate representation of the environment the students may find themselves in. To have the facilitator not visibly present seemed to push the students to become more critical with their decision making and force themselves to act instead of awaiting instruction. Although IST is termed immersive there are many different levels of immersion and levels of fidelity that can be utilized, this study was not comprehensive enough to determine these. Though it is important that the right level needs to be chosen for the skill and students that will be performing the skills to allow for a conducive learning environment. In this study no specific debrief was done, students followed the scenario by a questionnaire and focus group, when a debrief would normally occur. The students identified that a good debrief would have benefited them and could be considered.

Although there are more stimuli and extra realism enhancing points in IST it is worth noting that the environment is still a safe environment to allow for errors and mistakes without the fear of rebuke but rather support which is similar to the CST environment. The IST is not just a

complicated CST or aimed at replacing it, but a training environment which supports the CST in assisting the students to build a strong foundation and then develop further in preparation for the real world while developing and growing students' confidence.

Conclusion

This study has provided evidence that immersive simulation training enhances student confidence across disciplines, midwives and paramedics adding to the known benefits across nursing and the medical field. Additionally, it has highlighted that students find both conventional and immersive simulation training as a necessary part of their training to ensure that they cement their learning and become accustomed to the realities of their role when they become part of the work force. Finally, as was clearly demonstrated in this study not all simulated learning environments are the same but they all have their place in curricula as they have their own advantages.

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Table

Tables

	Mean	Standard Deviation	Confidence Interval [lower-upper bound]
CST	37.06	5.86	34.04 – 40.07
IST	43.76	2.61	42.42 – 45.10
Difference	6.71	6.09	3.57 – 9.84

Table 1 -Descriptive data for confidence values in CST, IST, and the difference

Difference from CST to IST in	Sample Number	Mean	Standard Deviation	Confidence Interval [lower-upper bound]
First year midwives	7	10	4.72	5.62 – 14.37
First year paramedics	10	4.4	6.05	0.06 – 8.73

Table 2 - Descriptive data for difference between confidence values across different groups of students

	Mean	Standard Deviation	Confidence Interval [lower-upper bound]
IST useful in preparing for real patients	4.65	0.70	4.28 – 5.00

Table 3 - Descriptive data of usefulness of IST

	Sample Number	Sig	Cohen's *d*
Test 1	17	<0.001*	1.479
Test 2	7+10	0.063	
Test 3	7	0.104	
Test 4	10	0.259	
Test 5	7+10	0.393	

Table 4 - Overview of inferential data for different tests

Figure

Figures

Figure 1 - The explanatory sequential design

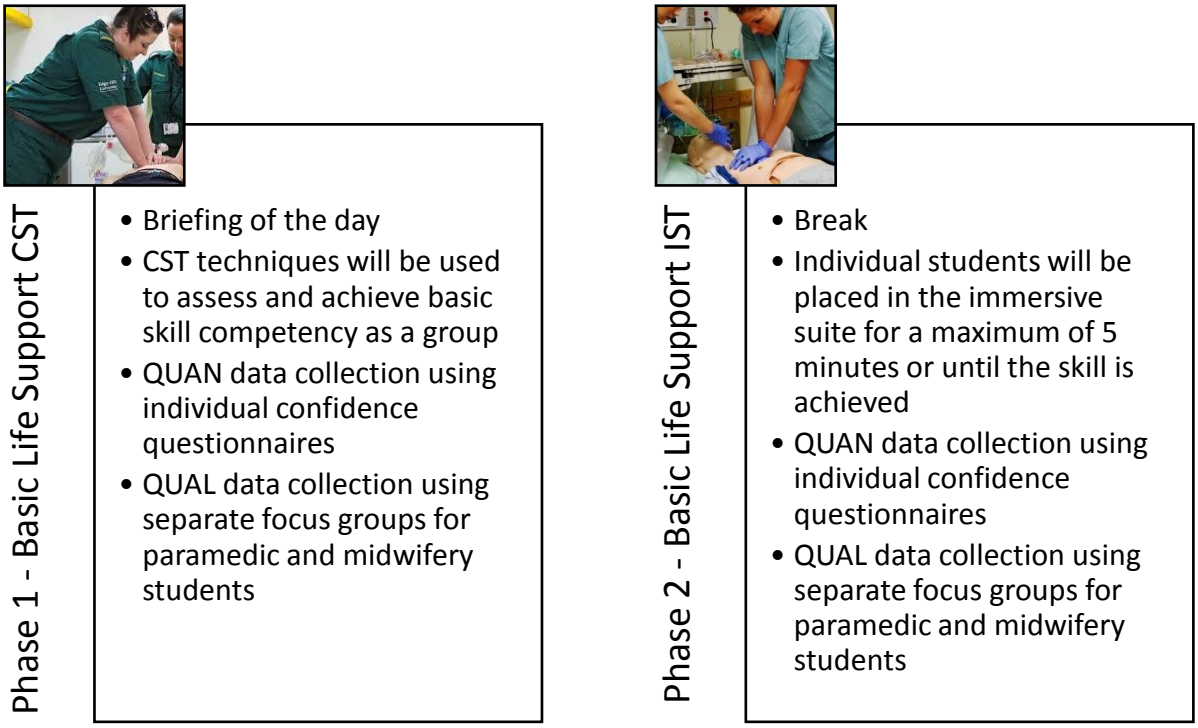

Figure 1 - Project phases - Outline

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***Credit Author Statement**

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